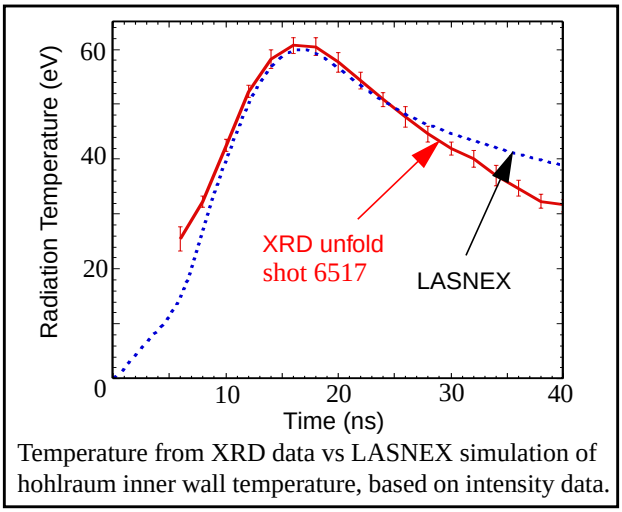
August 1995 Highlights of the Light Ion Inertial Confinement Fusion Program



Temperature from XRD data vs LASNEX simulation of hohlraum inner wall temperature, based on intensity data.

We completed electron beam blade load tests in the extraction (PBFA X) mode. Agreement of voltages and currents with simulations is good for 20-ohm and 30-ohm magnetically insulated transmission lines (MITLs). At high diode impedance, losses are more significant for a 10-ohm line, and damage occurs to MITL surfaces. Six short circuit shots and 17 blade load shots were obtained in ten days before a 1-1/2-week period to refurbish the vacuum insulator stack. Much of the hardware has now been installed for the initial extraction ion diode shots, which will use a 20-ohm MITL.

The first lithium evaporating metal foil anode plasma source (EMFAPS) shots were fielded on SABRE, with 18 shots in 22 days. A thick Mo heater film and a thick LiF source film (~ 0.2 μm each) reduce hydrogen thermal desorption from the epoxy substrate but require more current to evaporate and ionize lithium neutrals via a surface discharge. Glass and ceramic substrates will allow thinner films with reduced contaminant desorption. The EMFAPS experiments will continue until late October.

A meeting was held at the Naval Research Laboratory (NRL), with participation from NRL, Cornell University, Karlsruhe, and Sandia, to evaluate data from the 1-MV Gamble-II extraction diode. Protons from a wax-filled, grooved anode or a hydrogen EMFAPS will be used to study self-pinched transport. In this scheme, the beam focuses ballistically to less than 1 cm in radius and is then transported several meters while contained by its net self-magnetic field. Self-pinched propagation is attractive for standoff from blast and radiation effects for energy applications and is relevant to light and heavy ion fusion.

We hosted an interlaboratory workshop on pulsed-power-driven radiation sources. Attendees were from LLNL, LANL, SNL, NRL, Phillips Laboratory, University of New Mexico, Mission Research Corporation, and Russia. Vacuum hohlraum experiments on the 2-MV, 20-TW Saturn accelerator with an imploding plasma load were reviewed. Data and 2D simulations suggest the need for a 3D simulation capability to evaluate the impact of hydrodynamic instabilities generated by annular and uniform gas puff loads. The 3D hydrodynamics code ALEGRA (formerly known as RHALE) is being developed at Sandia for this purpose as well as for ICF target design, with assistance from LANL and LLNL.

The SNL code UFO was used to obtain time-resolved x-ray spectra and radiation temperatures from an array of filtered x-ray detectors (XRDs) on PBFA-II cylindrical hohlraum experiments. XRDs are one of several x-ray diagnostics that viewed the hohlraum interior. The spectral unfold gave a temperature of 61 ± 3 eV. New calibrations at the National Institute of Science and Technology verify that the XRD response function is very sensitive at low photon energies and confirm the unfold procedure of truncating the spectra below 98 eV. A comparison between the radiation temperature, derived from XRD data, and the temperature of the inner wall of the hohlraum, based on beam intensity data, is shown in the figure.

A design review for an active shock breakout diagnostic was given at LLNL. The diagnostic, developed and tested on Saturn, is being modified for the smaller targets and the larger temperature range on Nova. The Nova diagnostic will serve as a prototype for a National Ignition Facility diagnostic.

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